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Datasheet for the decision of 12 February 2020

Case Number: T 0177/17 - 3.2.04

Application Number: 09776199.3

Publication Number: 2337952

IPC: F03D7/04

Language of the proceedings: EN

Title of invention:
CONTROL OF WIND PARK NOISE EMISSION

Patent Proprietor:
Vestas Wind Systems A/S

Opponent:
Siemens Aktiengesellschaft

Headword:

Relevant legal provisions:
EPC Art. 56

Keyword:
Inventive step - (no)

Decisions cited:

Catchword:

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Beschwerdekammern

Boards of Appeal

Chambres de recours

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Case Number: T 0177/17 - 3.2.04

D E C I S I O N
of Technical Board of Appeal 3.2.04
of 12 February 2020

Appellant: (Opponent)	Siemens Aktiengesellschaft Werner-von-Siemens-Straße 1 80333 München (DE)
Representative:	Siemens AG Postfach 22 16 34 80506 München (DE)
Respondent: (Patent Proprietor)	Vestas Wind Systems A/S Hedeager 42 8200 Aarhus N (DK)
Representative:	Reeve, Nicholas Edward Reddie & Grose LLP The White Chapel Building 10 Whitechapel High Street London E1 8QS (GB)
Decision under appeal:	**Interlocutory decision of the Opposition Division of the European Patent Office posted on 23 December 2016 concerning maintenance of the European Patent No. 2337952 in amended form.**

Composition of the Board:

Chairman	A. de Vries
Members:	S. Oechsner de Coninck
	C. Heath
	S. Hillebrand
	T. Bokor

Summary of Facts and Submissions

I. The opponent appeals against the interlocutory decision of the Opposition Division of the European Patent Office posted on 23 December 2016 concerning maintenance of the European Patent No. 2 337 952 in amended form. The notice of appeal was filed on 20 January 2017, the appeal fee was paid on the same day, and the statement of the grounds of appeal was filed on 13 April 2017.

II. The opposition was based on the grounds of Article 100(b) and (a) EPC, the latter in combination with lack of novelty and inventive step. In its written decision the Opposition Division held that the patent as amended according to a main request complied with the requirements of the EPC, having regard in particular to the following documents:

D1: US 6,688,841 B1
ES3: A CRITICAL APPRAISAL OF WIND FARM NOISE PROPAGATION, FINAL REPORT, REPORT NO. 8, ISSUE 1, 27 January 2000

III. The Board issued a communication in preparation for oral proceedings and setting out its provisional view on the relevant issues.

IV. Oral proceedings were held on 12 February 2020.

V. The appellant requests that the decision under appeal be set aside and that the patent be revoked.

VI. The respondent requests that the appeal be dismissed, in the auxiliary that the decision under appeal be set aside and that the patent be maintained on the basis of the Auxiliary Requests 1 or 2, filed before the Opposition Division and re-filed with letter dated 18 August 2017.

VII. The wording of the independent claim 1 of the different requests reads as follows:

Main request

"Method of control of noise emission from a wind park in operation, the wind park comprising a plurality of wind turbines, the method comprising the steps of:

- providing measurements of at least one wind speed and of at least one wind direction to a park noise emission emulation module including for each of two or more of said plurality of wind turbines a wind turbine noise emission model being suitable for producing a prediction of noise emission from the wind turbine as a function of at least one operational characteristic, the geographical position of each of said plurality of wind turbines, and the geographical position of at least one noise immission point,
- emulating the noise level at the at least one noise immission point as a result of noise emitted by said plurality of wind turbines,
- controlling the operation of the wind park from the result of the emulation so as to prevent the noise level at the at least one noise immission point from exceeding a predetermined threshold level."

Auxiliary request 1 (amendments highlighted)

1. Method of control of noise emission from a wind park in operation, the wind park comprising a plurality of wind turbines, the method comprising the steps of

- providing measurements of at least one wind speed and of at least one wind direction to a park noise emission ~~emulation~~ simulation module including for each of two or more of said plurality of wind turbines a wind turbine noise emission model being suitable for producing a prediction of noise emission from the wind turbine as a function of at least one operational characteristic, the geographical position of each of said plurality of wind turbines, and the geographical position of at least one noise immission point,
- ~~emulating~~ simulating the noise level at the at least one noise immission point as a result of noise emitted by said plurality of wind turbines, and
- controlling the operation of the wind park from the result of the ~~emulation~~ simulation so as to prevent the noise level at the at least one noise immission point from exceeding a predetermined threshold level.

Auxiliary request 2 (amendments with respect to the main request highlighted)

1. Method of control of noise emission from a wind park in operation, the wind park comprising a plurality of wind turbines, the method comprising the steps of:

- providing measurements of at least one wind speed and of at least one wind direction to a park noise emission ~~emulation~~ simulation module including for each of two or more of said plurality of wind turbines a wind turbine noise emission model being suitable for producing a prediction of noise emission from the wind turbine as a function of at least one operational characteristic, the geographical position of each of said plurality of wind turbines, and the geographical position of at least one noise immission point, wherein the at least one operational characteristic includes one or more of the rotational speed of the rotor, the wind turbine power production and the blade pitch angle,
- ~~emulating~~ simulating the noise level at the at least one noise immission point as a result of noise emitted by said plurality of wind turbines, and
- controlling the operation of the wind park from the result of the ~~emulation~~ simulation so as to prevent the noise level at the at least one noise immission point from exceeding a predetermined threshold level.

VIII. The appellant argues as follows

- Starting from D1, the skilled person would obviously have considered that the simulation models evaluated in ES3 are suitable for replacing field measurements, and he would have implemented one of these models to adapt the control system of D1.
- The specification that the operational characteristic may include the rotational speed does not contribute to an inventive step, because D1 already discloses this characteristic as a main parameter for evaluating noise emission.

IX. The respondent argues as follows

- ES3 concerns modelling of wind farm noise in the planning phase of a wind farm. The skilled person would not have considered the use of such a design and planning tool for the actual control of an operational wind farm without hindsight.
- As for auxiliary request 2, the operational characteristic added in claim 1 improves the control of the wind park and is not suggested as input in any simulation model.

Reasons for the Decision

1. The appeal is admissible.

2. Background

2.1 The present patent is concerned with the control of noise emission from a wind park comprising a plurality of wind turbines. According to paragraph 0012 of the patent specification a more optimal operation of the wind park is sought without requiring permanent sound level measurements.

2.2 This is achieved by the method defined in claim 1 of the main request and corresponding to claim 1 as granted. This method includes the measurement of at least the wind speed and direction provided to a park noise emulation module, which includes for each wind turbine a noise emission model that produces a prediction of the noise *emitted* (produced at source) by the wind turbine as a function of the operational characteristic, for example wind speed or wind direction. The noise level at a given *immission* point (received at that point) as a result of noise emitted by the plurality of wind turbines in the park is then emulated, and the operation of the wind park controlled as a result of the emulation to prevent noise at the immission point exceeding a certain level.

2.3 Specification paragraph 0008 further explains that the wind turbine noise emission model used in the park noise emulation module to predict the noise level generated by each wind turbine of the park is typically based on extensive measurements of the noise emission from the wind turbine.

In paragraph 0009 of the specification the park noise emulation module is explained to be a "well known simulation model, where the individual wind turbine is handled as a noise source based on the wind turbine noise emission model and inter alia measured wind speed ... and the propagation of the noise and the total noise level at the ... immission points is calculated from well known principles". As can be inferred from paragraph 0009 the term "emulation" (where "emulate" normally means "to copy" or "to imitate") can only reasonably be understood as meaning computational simulation. Thus, the emulation model provides a computational estimate of noise level at the concerned immission point on the basis of the noise generated by each individual wind turbine as predicted using a wind turbine emission model. Paragraph 0008 states that such a model is typically based on extensive measurements of noise emission, so that the emitted noise can be obtained as a precise function of (measured) variables that may include wind speed and rotational speed.

3. Main request - inventive step

3.1 D1, cited in paragraph 0003 of the patent, is also concerned with noise control of a wind turbine, see title and first paragraph, and thus represents a good starting point for assessing inventive step.

This document discloses a wind energy system that maximizes energy yield while observing sound output limit values at one or more immission points, column 1, lines 36-40. It does so by measuring wind speed and direction and/or time of day (claim 1) or noise level at the immission point (claims 2, 10) and using this measured value to control for example rotation speed of the wind turbine. Control is effected by a data processing apparatus 11 for example a computer, which receives the relevant input (figure 2, column 3, lines 26-46).

The effects of the control concept are explained in an example in column 4, line 4 to 57. There, by reducing the rotary speed of the row closest to the immission point while increasing it in more distant rows, the resulting immission noise level is reduced (column 4, lines 32-40).

3.2 The method of claim 1 differs from this known control method by the features of a park noise emission emulation module receiving wind speed and direction measurement input and including the wind turbine noise emission module producing a prediction of noise emission for each wind turbine, and emulating immission noise level as a result of noise emitted by the plurality of wind turbines to then control operation of the wind park on the basis of this emulation. As noted, emulation is understood as computational simulation.

In essence, rather than using measured immission noise, the claimed method uses immission noise determined by computational simulation in which for each wind turbine emission noise is first predicted and then used to compute a simulated noise level at the immission point.

3.3 This use of noise level calculated by a sound emulation module means that measurement devices can be dispensed with, see paragraph 0012 of the patent. The resulting control method is consequently simpler and more versatile. Based on this effect, the objective technical problem may be formulated as how to provide an alternative, simpler and more versatile method of controlling noise emission from a wind park.

3.4 The relevant skilled person is an engineer involved in the planning, design and construction of wind turbines and their control, who will have a knowledge of the relevant parameters and requirements as regards immission noise. Such a skilled person will for example be familiar with the literature regarding noise generation in the vicinity of wind turbines or wind turbine parks, and the role it must play in planning, cf. column 1, lines 9 to 12 of D1. Thus they would know ES3, an appraisal of existing wind turbine noise propagation models for planning purposes. This document in particular provides an overview of a variety of known models for predicting noise immission levels, listed on page 37, chapter 8. Some of these are found to demonstrate a high level of accuracy, see page 47, last paragraph.

Page 3, chapter 1.2.1, outlines the general methodology of modelling immission noise in the design of wind turbines, and which is also adopted in ES3's appraisal. It includes the following steps :

i): determination of the noise emission (at source) of the wind turbines obtained from the manufacturer's noise specification,

..

iii): calculation of the noise immission at appropriate, that is nearby, locations for each wind turbine in turn using a propagation model,

iv): summing up the individual contributions (from each turbine) to determine the overall noise level from the wind farm.

In this methodology, each wind turbine is considered as an individual noise source as input into a propagation model that then calculates that turbine's contribution to the accumulative noise level at an immission point. Step i) requires knowledge of noise level at source. In its appraisal ES3 uses existing wind farm noise data, cf. section 8.0, 2nd paragraph in reference to Task C, which is described in detail in section 6.0, pages 33 to 36. The noise data are logged together with wind speed and direction as well as location data of turbines and topography. In its conclusions ES3 in section 11.0 identifies vector wind speed as well as ground topography as important factors influencing estimated immission noise level (page 58, top, 2nd to 7th item), as also indicated in the executive summary, 5th and 6th paragraphs. The inference is that these factors are operational parameters of the propagation models considered.

Summing up, ES3 discloses a simulation methodology in which for each individual wind turbine empirical noise emission data, logged together with relevant wind speed and topographic data (or noise specification data) is used as input into a propagation model, which is *inter alia* wind speed dependent, to estimate the immission noise from that wind turbine at an immission point. That is then summed for all wind turbines of the park to estimate the overall noise level at the immission point. This methodology corresponds to the emulation/ simulation steps identified above as differences vis-a-vis D1.

3.5 In the Board's view the skilled person, starting from D1 and looking for an alternative would draw on their knowledge of propagation models as discussed in ES3 to replace actual measurement by a simulation. This is all the more so, as D1 itself already suggests the use of historical immission noise data instead of measuring the actual immission noise level.

Thus, D1 in column 3, lines 28-33, suggests using sound level values that are *assumed* to have occurred on the basis of previous measurements instead of measured values. This implies some historical model that effectively predicts the noise level on the basis of past values. The most likely form that this would take is a look-up table stored in data processing apparatus or computer 11. Whatever form it takes, D1 thus already suggests a predictive, data based determination or estimation of immission noise as an alternative to direct measurement, even if it provides little or no detail as to how this is realized.

Motivated by this suggestion in D1, the skilled person would as a matter of obviousness also consider other known data based models used for determining immission noise, such as the simulation methodology discussed in ES3. That methodology can be adopted in a straightforward manner, with empirical emission noise data used as input for the propagations model and using the relevant vector wind speed, i.e. wind speed direction and magnitude, as parameters. The use of empirical data, might again be as described in ES3, e.g. as discussed in section 6.0, in the form of a look-up table with emission levels set against relevant measured values such as temperature, pressure, wind speed and direction as mentioned in section 6.1. An alternative is to use the manufacturer's noise specification as mentioned in step i) of the general methodology. Rather than providing a single noise level at some rated rotational speed, as argued by the

Respondent, the Board believes that such a specification provides a multiplicity of noise levels for different rotational speeds, much as the example of the graph of figure 1 of D1 drawn up for a E-66 Enercon wind turbine. In either case, whether using empirical data or the manufacturer's noise specification, these represent wind turbine noise emission models in the sense of claim 1 and are typically based on extensive measurements as mentioned in paragraph 0008 of the patent specification.

3.6 The respondent in this regard refers to the paragraph bridging pages 1 and 2 in ES3 to explain that the modelling of wind farm noise takes place to assess accuracy of the prediction only in the planning phase of a wind farm; ES3 is thus concerned with simulation only as a planning tool. The skilled person would not have considered the use of such a planning tool out of this context to predict actual noise produced by an existing wind turbine park in order to control noise of an operational wind farm without hindsight.

3.7 The Board disagrees. In the Board's view it is in particular relevant that D1 itself already considers a data based, predictive approach. In the opinion of the Board, this means that the skilled person will also as a matter of course consider other suitable predictive approaches that provide a realistic indication of the immission noise level. Clearly, the approaches described in ES3, even if used for planning purposes, must provide a realistic indication of immission noise - indeed this is one of the main objectives of the ES3 appraisal, i.e. how accurate the predictions are, see section 9.1. Nor is there anything to indicate that this methodology would somehow be unfit or unsuitable for control as in D1. Finally, no particular major adaptation of the ES3 scheme is required for applying it to the control system of a wind park as in D1.

The Board furthermore does not consider the planning of a non-existing wind park as in ES3 and the control of an existing wind park as in D1 to be fundamentally different or mutually exclusive. D1 relates the advantage of the control system proposed to advantages for planning and implementing aspects of wind park (column 4, lines 58-63). Thus it already establishes a close relationship between planning and operation, and more particularly between sound immission calculations and sound immission measurements (column 1, lines 9-17).

Consequently, the obvious adoption of the methodology of ES3 instead of direct measurement of immission noise results directly in the control scheme as claimed in claim 1 of the main request. The claimed method therefore lacks an inventive step within the meaning of Articles 52(1) and 56 EPC.

4. First and second auxiliary requests

4.1 Claim 1 according to the first auxiliary request replaces the term "emulation" by the term "simulation". As already indicated in item 2 above, both terms are understood as synonyms in the context of the present patent. Therefore, the conclusion of lack of inventive step for the main request also applies to claim 1 of this request. This was indeed not disputed by the respondent.

4.2 Claim 1 of the second auxiliary request further specifies the "operational characteristics" (understood to mean parameters) of claim 1 of the first auxiliary request to include one or more of rotational speed, wind turbine power or blade pitch angle.

4.2.1 The respondent submits that the use of this/these operational characteristic/s improve(s) the control of the wind park and is not suggested as input in any model simulation model.

4.2.2 The Board does not agree. D1 for example indicates the relationship of sound generation to the fifth power to the blade tip speed, the blade tip speed itself being dependent on the rotary speed of the rotor (e.g. Column 1, lines 65-67). Indeed, figure 1 relates noise emission to rotary speed. D1 thus clearly already identifies rotary speed (i.e rotational speed) as a critical parameter determining the noise generated by the wind turbine. Thus, the rotational speed for the prediction of noise generated by a wind turbine represents precisely the key parameter that influences the production of noise. The skilled person will as a matter of course consider this parameter for estimating noise generation. Therefore, the additions to claim 1 of the second auxiliary request do not contribute to inventive step.

5. The Board concludes that none of the amended versions of claim 1 according to the requests on file involve an inventive step within the meaning of Articles 52(1) and 56 EPC. Thus, the patent as amended fails to meet the requirements of the EPC. Pursuant to Article 101 (3)(b) EPC the patent must then be revoked.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The patent is revoked.

The Registrar: The Chairman:

G. Magouliotis A. de Vries

Decision electronically authenticated